

CLAIMS

1. A continuous process for the hydroformylation of propylene comprising feeding
 - (i) a propylene stream at a rate of at least 3 tonnes per hour, and
 - (ii) synthesis gas comprising hydrogen and carbon monoxide to a hydroformylation reactor wherein the propylene is hydroformylated over a rhodium containing catalyst, and wherein
 - (a) the propylene stream contains at least 97 mole % of propylene;
 - (b) the molar ratio of (H₂+CO) contained in the fresh synthesis gas fed to the reactor, to the propylene contained in the fresh propylene stream fed to the reactor, is greater than 1.93; and
 - (c) in the synthesis gas feed, the hydrogen over carbon monoxide molar ratio is from >1:1 to 1.2:1
2. The process according to claim 1 wherein the propylene stream contains at least 99.5 mole % of propylene.
3. The process according to claim 1 wherein the sulphur content of the propylene feed is not greater than 500 ppb by weight, calculated on an atomic basis.
4. The process according to claim 3 wherein the reactive nitrogen content of the propylene feed is not greater than 10 ppm by weight, calculated on an atomic basis.
5. The process according to claim 4 wherein the chlorine content of the propylene feed is not greater than 5 ppm by weight, calculated on an atomic basis.

6. The process according to claim 5 wherein the chlorine content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
7. The process according to claim 4 wherein the reactive nitrogen content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
8. The process according to claim 7 wherein the chlorine content of the propylene feed is not greater than 5 ppm by weight, calculated on an atomic basis.
9. The process according to claim 8 wherein the chlorine content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
10. The process according to claim 3 wherein the chlorine content of the propylene feed is not greater than 5 ppm by weight, calculated on an atomic basis.
11. The process according to claim 10 wherein the chlorine content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
12. The process according to claim 3 wherein the sulphur content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
13. The process according to claim 12 wherein the reactive nitrogen content of the propylene feed is not greater than 10 ppm by weight, calculated on an atomic basis.

14. The process according to claim 13 wherein the chlorine content of the propylene feed is not greater than 5 ppm by weight, calculated on an atomic basis.
15. The process according to claim 14 wherein the chlorine content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
16. The process according to claim 13 wherein the reactive nitrogen content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
17. The process according to claim 16 wherein the chlorine content of the propylene feed is not greater than 5 ppm by weight, calculated on an atomic basis.
18. The process according to claim 17 wherein the chlorine content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
19. The process according to claim 12 wherein the chlorine content of the propylene feed is not greater than 5 ppm by weight, calculated on an atomic basis.
20. The process according to claim 19 wherein the chlorine content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
21. The process according to claim 1 wherein the reactive nitrogen content of the propylene feed is not greater than 10 ppm by weight, calculated on an atomic basis.

22. The process according to claim 21 wherein the chlorine content of the propylene feed is not greater than 5 ppm by weight, calculated on an atomic basis.
23. The process according to claim 22 wherein the chlorine content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
24. The process according to claim 21 wherein the reactive nitrogen content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
25. The process according to claim 24 wherein the chlorine content of the propylene feed is not greater than 5 ppm by weight, calculated on an atomic basis.
26. The process according to claim 25 wherein the chlorine content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
27. The process according to claim 1 wherein the chlorine content of the propylene feed is not greater than 5 ppm by weight, calculated on an atomic basis.
28. The process according to claim 27 wherein the chlorine content of the propylene feed is not greater than 50 ppb by weight, calculated on an atomic basis.
29. The process according to claim 18 wherein the aggregate weight content in the propylene feed of sulphur and reactive nitrogen and chlorine, on an atomic basis, is less than 50 ppb.

30. The process according to claim 1 wherein the hydroformylation catalyst is an oil-soluble rhodium complex comprising a low valence rhodium (Rh) complexed with a triorganophosphorus compound.
31. The process according to claim 30 wherein the triorganophosphorus compound is selected from the group consisting of an oil-soluble triarylphosphine, trialkylphosphine, alkyl-diaryl-phosphine, aryl-dialkylphosphine, triorganophosphite and bisphosphite containing, per molecule, at least one phosphorus atom capable of complexing with Rh.
32. The process according to claim 31 wherein the triorganophosphorus compound is triphenylphosphine or 6,6'-[[3,3',5,5'-tetrakis (1,1-dimethylethyl)-1,1'-biphenyl-2,2'-diyl] bis (oxy)] bis-dibenzo [d,f] [1,3,2]-dioxaphosphepin.
33. The process according to claim 1 wherein the Rh concentration in the hydroformylation reaction mixture is in the range of from 1×10^{-5} to 1×10^{-2} moles/liter.
34. The process according to claim 1 wherein the hydroformylation is carried out at a temperature in the range of from 40 to 200°C.
35. The process according to claim 1 wherein the hydroformylation is carried out at a pressure in the range of from 0.05 to 10 MPaa.
36. The process according to claim 1 wherein the carbon monoxide partial pressure in the reactor is not greater than 50% of the total pressure.
37. The process according to claim 1 wherein the propylene feed stream contains up to 5000 ppb by weight of dimethyl ether.

38. The process according to claim 37 wherein the propylene feed stream contains, by weight and on an atomic basis, less than 50 ppb sulphur, less than 50 ppb reactive nitrogen and less than 50 ppb chlorine.
39. The process according to claim 38 wherein the aggregate weight content in the propylene feed of sulphur and reactive nitrogen and chlorine, on an atomic basis, is less than 50 ppb.
40. The process according to claim 1 wherein the molar ratio of (H₂+CO) to propylene is greater than 1.94.
41. The process according to claim 1 wherein the molar ratio of hydrogen to carbon monoxide is from 1.1:1 to 1.2:1.
42. The process according to claim 1 further comprising aldolising the hydroformylation product, followed by hydrogenating the aldolisation product to form an alcohol product selected from 2-ethyl-hexanol and mixtures containing 2-ethyl-hexanol.
43. The process according to claim 1 wherein a product of the process of claim 1 is a butyraldehyde, the process further comprising hydrogenating the butyraldehyde to the corresponding alcohol.
44. The process according to claim 1 wherein a product of the process of claim 1 is a butyraldehyde, the process further comprising oxidizing the butyraldehyde, to the corresponding acid.